



Ministry of the ENVIRONMENT

TOWNSHIP OF AMELIASBURGH

A Survey of

FENWOOD GARDENS WATER WORKS SYSTEM

DISTRICT ENGINEERS SECTION

SANITARY ENGINEERING BRANCH

1972

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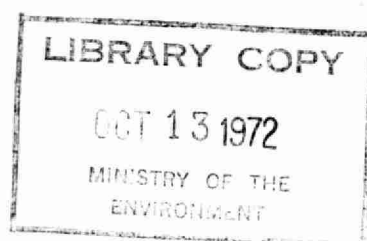
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TOWNSHIP OF AMELIASBURGH
A SURVEY OF
FENWOOD GARDENS WATER WORKS SYSTEM

INTRODUCTION

A complete review was made of the treatment facilities, distribution system and quality of water in the Fenwood Gardens Subdivision in part of Lot 66, Concession 2, Township of Ameliasburgh, during the months of March and April, 1972. The survey was conducted by staff of the Sanitary Engineering Branch and Technical Advisory Services Section, Ministry of the Environment.

Information provided by Mr. W. Nightingale, Clerk, Township of Ameliasburgh; Mr. J. Parrott, President, Stanley Park Limited, and members of the Fenwood Gardens Ratepayers Association, was deeply appreciated.

SUBDIVISION GROWTH

Residential homes built on 32 lots have a combined population of approximately 100 persons. When the total 50 lots (approximate) are filled, a population of 150 to 175 would be expected.

GEOLOGY

Dense, grey, Trenton limestone underlies the area mainly at shallow depths. Overburden consisting of clay or a mixture of clay and gravel is normally less than eight feet in the subdivision. In the marsh, north of the subdivision, ten feet of clay, five feet of sand and eight feet of gravel overlies the limestone bedrock.

HISTORY OF EVENTS

In chronological order, the writer has listed the course of events from the time the Fenwood Gardens Subdivision was under

consideration by the developer until the recent reported problems.

In 1964, the Prince Edward County Health Unit requested advice from the *Ontario Water Resources Commission (now Ministry of the Environment) on the possibility of providing a community water supply for the subdivision. After reviewing the well drilling records, the Commission indicated that developing an adequate groundwater supply in the area was rather remote. To confirm the well drilling data, a further groundwater survey was carried out in the spring of 1963 by staff of the Water Resources Division. The report concluded that the hydrogeological conditions in the overburden were generally unfavourable for the required water supply, however, there was a possibility of encountering a buried channel of water in the marshy area to the north of subdivision.

Three wells were subsequently drilled in this area by Mr. Parrott and the required capacity for the subdivision was available. The wells were reported to have the following characteristics:

<u>Well No.</u>	<u>Depth</u>	<u>Test Pumping Rate</u>
4	28'	30 gpm*
5	30'	50 gpm
6	30'	30 gpm

* gpm - gallons per minute

* The Ontario Water Resources Commission (OWRC) was incorporated into the Ministry of the Environment in 1972. The writer will still refer to the OWRC when discussing the Fenwood Gardens Subdivision issue.

Mr. W. O. Chisholm, Consulting Engineer, acting on behalf of the developer submitted preliminary engineering plans and a report on the water supply system on August 12, 1963 for commission approval. Enclosed was the chemical results of a sample collected from Well # 4.

<u>Date</u>	<u>Hardness as CaCO₃</u>	<u>Alkalinity as CaCO₃</u>	<u>Iron as Fe</u>	<u>Chloride as Cl</u>	<u>pH at Lab</u>
Sept 14/63	266	308	4.00	40	7.4

Note: All results reported in parts per million (ppm)

As noted, the iron concentration vastly exceeded the recommended objective of 0.3 ppm.

After reviewing the submission, Mr. G. T. Trewin requested that the following items be looked after before approval would be granted.

- 1) The pressure tank size be increased.
- 2) The subdivider obtain an agreement with the municipality as to the ownership and operation of the water system after installation. A confirmation of the agreement was required from the municipality.
- 3) The final submission report include bacteriological and chemical analyses of water samples collected from the proposed wells.

On July 9, 1963, staff inspected the system and found the iron concentration of the water to be 360 ppm. Obviously, iron deposits in the system must have sloughed into the sample at the time of collection. In view of the frequent fluctuations with the iron concentration, it was recommended that further samples be collected.

On October 1, 1963 chemical samples were obtained from Well # 5 and Well # 6 by the developer and submitted to the Ontario Water Resources Commission laboratory for analyses. The results were as follows:

<u>Well No.</u>	<u>Hardness as CaCO₃</u>	<u>Alkalinity as CaCO₃</u>	<u>Iron as Fe</u>	<u>Chloride as Cl</u>	<u>pH at Lab</u>	<u>Fluoride as F</u>
5	340	308	4.80	34	7.2	0.1
6	208	288	0.15	14	7.3	0.1

Note: All samples reported in ppm

Since there started to evolve a real concern about the high iron concentration, water conditioning companies were considering installation of their particular forms of treatment in order that the developer could get approval for the works.

The iron concentration continued to be high as evidenced by a sample obtained on September 14, 1963 - 4.00 ppm as Fe.

On September 11, 1963, Mr. Chisholm submitted final plans for approval, however, our Design Approvals Branch held the application in abeyance pending a receipt of a proposal to treat the iron. The consultant withheld submitting the requested information on the treatment facilities until he had an opportunity to conduct further field tests in the spring of 1964.

On April 22, 1964 Mr. Chisholm wrote the commission indicating that he had proceeded to surge and clean Well # 6. In addition, a new well (Well # 9) with a capacity of 30 gpm had been developed. The iron concentration of the samples obtained by Mr. Chisholm and submitted to the OWRC laboratory was as follows:

<u>Date</u>	<u>Well No.</u>	<u>Iron as Fe (ppm)</u>
March 23, 1964	6	0.07
April 4, 1964	9	0.15

This increased information was submitted with the original application and constituted the basis for the approval of the system.

On May 7, 1964 approval was granted to the Municipal Corporation of the Township of Ameliasburgh for the construction of the proposed water mains, including service connections from the distribution main to the property line, together with the development and equipping of two deep wells, one 30 gpm and the other 23 gpm, and the construction of a pumphouse including a 1000 gallon pressure tank, flow meter, controls and appurtenances all in accordance with the plans prepared by W. O. Chisholm. The approval certificate was signed by Mr. A. Miller, Reeve, and Mr. T. Walker, Clerk.

On April 5, 1967 an inspection was made of the works by staff of the District Engineers Branch and the iron concentration at that time was found to be 0.52 ppm. Based on the investigation, it was recommended that a routine sampling program be initiated. In addition, it was further recommended that the township and the developer clarify the ownership contract for the system.

In April 1969 another inspection was made and this time the iron concentration was ascertained to be 1.45 ppm. As the sample was obtained from the pressure tank it was therefore impossible to say what well the water originated from. Staff again recommended to the developer that the position with regards to the ownership be solved. Mr. Parrott reported that he had approached the municipality at the time the system was started and apparently they would not consider taking over the facilities until two-thirds of the lots had been built on.

Early in 1970, our staff discussed the issue with the township council who expressed a reluctance to take over the system until the problems were rectified. Once however all the regulatory

bodies were satisfied the township indicated they would be willing to accept ownership.

On April 7, 1971 the water was sampled again and found to have an iron concentration of 1.6 ppm.

After obtaining yet another sample in the fall of 1971, with an iron concentration of 2.2 ppm, a recommendation was made to Mr. Parrott to provide adequate treatment for the iron. The services of Triangle Plumbing and Heating Supply Limited were subsequently acquired by the developer and in December 1971 approval was requested for the provision of sodium silicate treatment. Although approval was not granted until February 24, 1972, Mr. Parrott was given verbal permission to install the treatment facilities. Reportedly, the treatment works were in operation since early January, 1972. At the request of the writer, Mr. Parrott was also informed to flush the mains thoroughly which was intended to remove some of the iron deposits accumulated in the mains.

Gradually verbal complaints were received at the Kingston Regional Office and on February 29, 1972 a very extensive letter was received from the Fenwood Gardens Ratepayers Association summarizing the problems with the system. A request was made to the Ministry of the Environment to rectify the inadequacies with the system. This course of events eventually lead to meetings with Mr. Parrott, members of the Ratepayers Association, and Mr. Nightingale, Clerk, Township of Ameliasburgh. Before making any firm decisions on what was required to alleviate the problems, it was necessary to conduct a complete survey of the system and this was subsequently done on April 5, 1972. In addition, staff of the Technical Advisory Services Section made an extensive review of the treatment facilities mainly

to determine the proper application rate of sodium silicate necessary to establish iron stability.

WATER SUPPLY SYSTEM

INTRODUCTION

As outlined previously, the residential subdivision is located in part of Lot 66, Concession 2, Township of Ameliasburgh, adjacent to Highway # 14 and approximately three miles south of Belleville. The present owner of the subdivision is Mr. John M. Parrott, President of Stanley Park Limited.

WATER SOURCE

<u>Well No.</u>	<u>Depth</u>	<u>Test Pumping Rate</u>	<u>Location</u>
4	28'	30 gpm	located 70' west of pumphouse
5	30'	50 gpm	located 50' west of pumphouse
6	30'	30 gpm	located in pumphouse
9	-	30 gpm	located in pumphouse

All wells are being used except Well # 5.

PUMPHOUSE

- 12' square cement block structure containing two wells and associated pumping equipment treatment facilities and 1000 gallon pressure tank.

TREATMENT

- sodium silicate treatment added by a chemical feed pump.

PUMPS

3 - Jacuzzi Jet Pumps rated at 1775 gph @ 57 psi and driven by Wagner Leland electric motors.

DISTRIBUTION SYSTEM

-the distribution system is looped and consists of 3" diameter ABS plastic pipe which reduces to 2" diameter pipe in the system.

- double service connections 3/4" diameter with 3/4" x 1/2" x 1/2" curb stop
- single service connections 3/4" diameter with 1/2" curb stop.

SURVEY

Pressure tests were carried out at 19 homes by attaching a pressure gauge to one of the plumbing fixtures, opening the tap and reading the pressure. To evaluate the distribution system in its entirety, a second pressure reading was taken after another tap on the system had also been turned on. The results of the survey are indicated in Table One.

SODIUM SILICATE TREATMENT

The sodium silicate treatment process was thoroughly studied by the Technical Advisory Services Section, Ministry of the Environment.

Normally, sodium silicate addition for iron control along with marginal chlorination has been employed with raw water iron values of less than 1.5 mg/l (milligrams per litre). As the level of iron at Fenwood Gardens is higher than experienced previously for this type of treatment, several investigations and studies were required.

Certain changes had to be made to the original plumbing and piping in the pumphouse to provide ideal chemical dosing points. The system uses Well pumps # 6 and # 9 to provide water to the subdivision while pump # 4 is used on a standby basis at this time. (Pump numbers correspond to the well number). Discharge lines from Wells # 6 and # 9 join in a "Y" connection and form a common line into which the two chemicals, sodium silicate (SiO_2) and sodium hypochlorite (NaO Cl) are added.

TABLE ONE - RESULTS OF PRESSURE AND BACTERIOLOGICAL SURVEY OF THE DISTRIBUTION SYSTEM AT PENWOOD GARDENS, TOWNSHIP OF AMELIASBURGH

<u>LOT NO.</u>	<u>INITIAL PRESSURE psi</u>	<u>PRESSURE WHEN ONE SERVICE TURNED ON psi</u>	<u>INDIVIDUAL TREATMENT</u>	<u>BACTERIOLOGICAL RESULTS</u>	<u>COMMENTS</u>
4	50	43	softener	satisfactory	House relatively new, approximately two years.
6	41	31	softener	"	
12	40	30	softener	"	Odour detected
32 & 33	38	35	softener	"	In 1971 developer cleaned lateral resulting now in adequate pressure. Previous to cleaning only a dribble of water obtained.
34	-	-	none	"	No pressure taken as connection to fixture impossible.
35	32	25	softener	"	
36	28	24	softener	"	
37	25	10	softener	"	Drop in pressure very noticeable. Impossible to use several outlets at same time.
39	32	14	softener	"	Very low flow at kitchen tap when another faucet in use.
45	52	30	softener	"	
46	32	15	softener	"	While two facilities on, eg. two taps, flow very low.
48	40	20	softener	"	
49	25	20	softener	"	While washer on, hardly trickle in kitchen tap. One of older homes in subdivision.
50	33	10	softener	"	Nearly impossible to turn two facilities on at same time and obtain adequate amount of water.
51	35	10	softener	"	Worst residence in subdivision for adequate pressure & flow
54	35	25	softener	"	Several utility outlets on very minimum if any flow
55	44	32	softener	"	
56	27	22	softener	"	
57	30	20	softener	"	New house
59	40	30	softener	"	

Well # 4 has a separate line which joins in the main line by means of a "T" connection which directly proceeds the water meter. As the system now exists, all water from Wells # 6 and # 9 will be subject to the addition of chlorine and silica. The water from # 3 well, used on a standby basis, will be mixed with the water from the other two wells and although the concentration of the chemicals being added will be reduced on a concentration basis, no oxidation and/or settling of iron should occur. The actual dosage in mg/l of Si O_2 has not been determined due to the shortness of time, priority of the project and the number of problems encountered. This dosage will be determined by checking the results of samples taken. The chlorine dosage is sufficient to provide a residual of 0.3 to 0.5 mg/l leaving the pumphouse.

Essentially, silica in the form of silicate is added to the water to retain the iron in solution indefinitely - well past consumer use. This therefore prevents the occurrence of the normal problems associated with excessive concentrations of iron.

SUMMARY AND CONCLUSIONS

1. Many residents in the subdivision are not receiving the benefit of adequate pressure and flow.
2. When the lateral from the street line to the house on lots number 32 and 33 was dug up in 1971 and subsequently cleaned, it is believed some of the relieved material was transported along the distribution system and into other laterals. It appears that the pressure at the household on lots number 32 and 33 is now adequate. It was curious to note that many residents indicated that they noticed a drop in pressure while and after the developer was working on the above-noted laterals.

3. In view of the low and fluctuating pressures over half of the residents interviewed reported that they cannot utilize two or three household plumbing fixtures and appliances at the same time, eg. kitchen tap, laundry tap, showers, tank toilet, washing machines. In addition, some of the housewives indicated that they must stagger the washing days and times in order to have a sufficient supply.
4. Many consumers complained that red water had occasionally been observed in their domestic water supply. During the investigation red water was observed when some of the outside taps had been turned on, however, many of these fixtures had not been used since the fall. The Ministry has received several complaints during the last month related to red water.
5. At the residence of Mr. Anderson, staff detected a distinctive odour probably as a result of iron-forming bacteria being prevalent in the lateral systems. The odour was characteristic of hydrogen sulphide. Since Mr. Anderson is at the extremity of the system, the water can become "stale" thus resulting in the problems found during the investigation. Only by frequent flushing will this condition be alleviated.
6. All but one household in the subdivision employ water softeners to reduce the high total hardness (400 mg/l).
7. On May 7, 1964, the Ontario Water Resources Commission approved the construction of the water works system in the Fenwood Gardens Subdivision under certificate # 64-B-177. The plans, specifications and engineering report were submitted by the Municipal Corporation of the Township of Ameliasburgh and subsequently approval was given to the township.

8. The plans submitted for approval Dwg. No. 56-D-231, dated August 1963, included the distribution system and service connections to the property line.
 9. Apparently, no agreement exists between the township and the developer concerning operation of the works. In fact, the only agreement reported to the writer exists between Mr. Parrott and the individual homeowners in the subdivision. When the consultant submitted the plans and report for approval, it was stated that the water system would be turned over to the municipality after the period of guaranteed maintenance on the works had expired.
 10. As a result of several visits by staff of the Technical Advisory Services Section, Ministry of the Environment, sodium silicate (Si O_2) and sodium hypochlorite (Na O Cl) addition to the raw water has been stabilized. The addition of these two chemicals should provide adequate sequestration of the iron in the raw water. Since the Technical Advisory Services Section is interested in this project from both an experimental and practical point of view, they will endeavour to make subsequent checks as to the effectiveness of the treatment.
 11. With the present treatment process, no problems of iron settling and/or tuberculation (1) are expected. No tuberculation will occur in the polyvinylchloride lines. The amount of iron previously present will not occur in the future providing silicate treatment is continued.
- (1) Tuberculation: building of tubercles on the inside walls of water mains. Such tubercles could grow by accretion to such an extent that they nearly fill the pipeline.

12. Preliminary investigations would indicate plugging at the point in the lateral where the 2" galvanized "T" connects with the 3/4" soft copper service line. It is quite possible that an electrolytic cell exists here and corrosion products are formed. Silica would eventually coat this pipe and alleviate this problem.
13. Iron deposition in the household plumbing has occurred also resulting in reduced carrying capacity.
14. The pumps were found to kick in when the pressure fell below 27 psi and stopped when 53 psi was reached. In view of the small size of the distribution system and the numerous expected obstructions, the operating pressure range for the system should be 40 to 60 psi.
15. The size of the polyvinylchloride mains is adequate to supply water to the residents. When the wells were developed (# 4, # 6 and # 9) the total capacity was estimated to be 90 gpm certainly adequate to meet peak consumption demands. At present, the capacity of the wells is unknown.
16. A by-law is required by the company to operate the utility in the township. These conditions are set forth in The Public Utilities Act and The Municipal Franchise Act.

RECOMMENDATIONS:

1. The water works system should be operated similar to other utilities in the province. The service connection which extends from the main in the street to the property line should be maintained by the owner or utility while the portion extending from the property line to the building be maintained by the consumer. To ensure proper installation and practices are being followed the owner or utility should be notified of all repairs to the lateral.

2. In view of the limited agreements now in force, it is strongly recommended that the operating authority define regulations and specifications for service maintainance and installations and should also set forth responsibilities for payment of costs. The specifications should include sketches, details and information necessary to provide a complete understanding of all requirements. The lack of such knowledge can result in misunderstandings and strained relations.
3. The desired pressure on the highest plumbing fixture within the building should not be less than 20 psi for proper operation of the fixtures. The operating pressure range for the system should be 40 to 60 psi.
4. Chlorine and sodium silicate chemical pumps should be checked frequently to ensure that they are in fact pumping the chemicals into the raw water.
5. Chlorine residual checks should be made daily to ensure maximum consumer protection.
6. All chemical solutions should be prepared using softened water to prevent calcium carbonate precipitation which would plug the feed pumps. The use of additives such as "Calgon" will not prevent this precipitation.
7. Since well yields may decrease when iron deposits are prevalent, draw down gauges should be installed to evaluate the pumping and static water levels.
8. A check on the capacities, draw down characteristics, well screens and present static levels of the three wells should be undertaken.

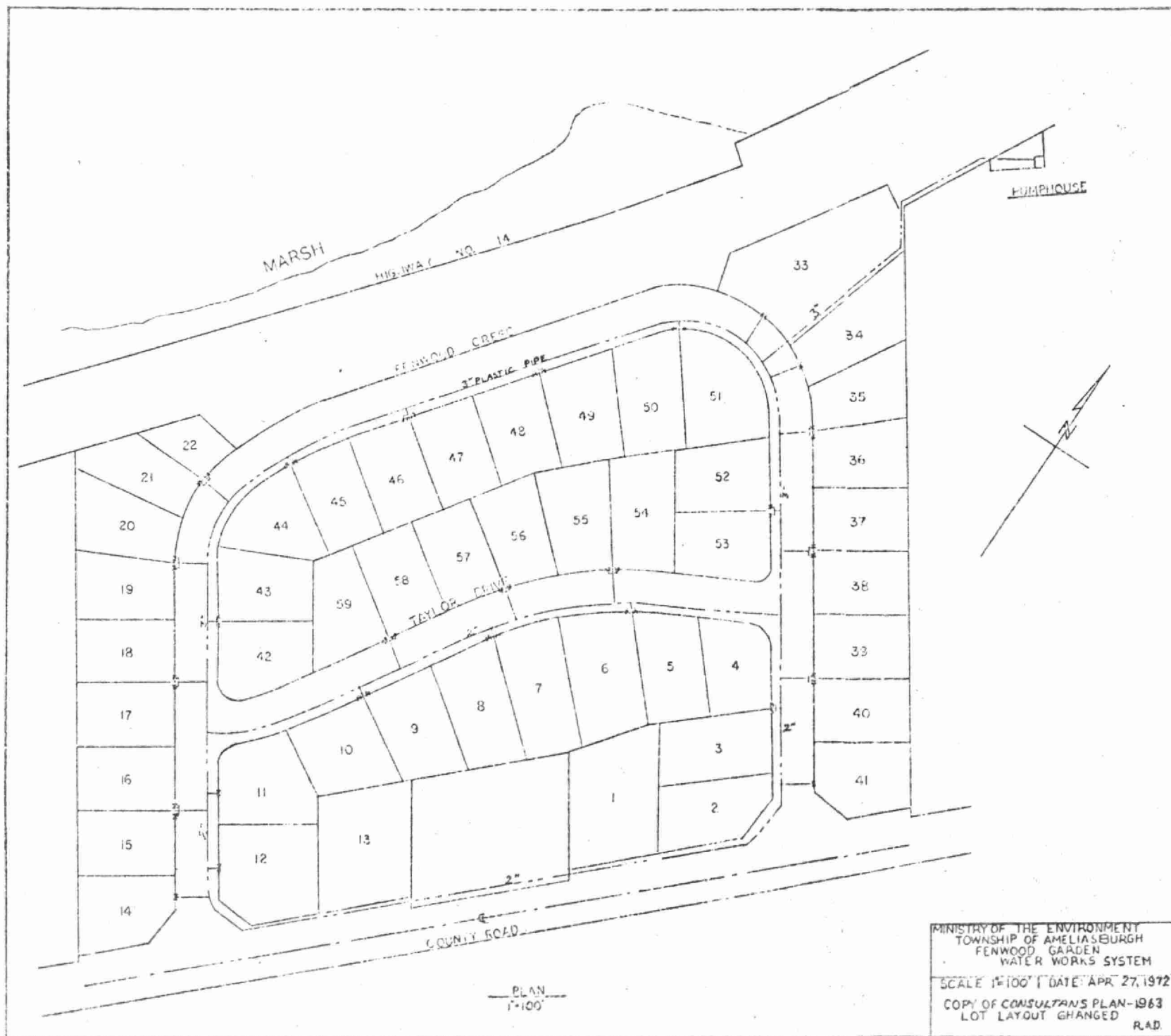
9. Plumbing changes should be made at the pumphouse to ensure that discharge water from Well # 4 enters the same line as does the discharge water from Wells # 6 and # 9 in order to provide silicate and chlorine addition to all water in a pre-pressure tank position.
10. There should be a definite program of proper maintenance and efficient operation to ensure that a high quality of water is being conveyed to the consumer. Lack of such a plan can result in not only costly repairs but poor and unsatisfactory service to the consumer.
11. Extreme care must be taken to prevent back-siphonage, especially where the pressure is low. The importance of maintaining a proper chlorine residual is realized for such occurrences.
12. The operating authority should keep accurate, concise and continuing records of the water works distribution system and treatment.
13. Addition of three or four more blowoff valves should be installed at strategic positions in the system to enable adequate cleaning.
14. Cleaning out of laterals and copper service lines should be undertaken. This should be done at several residences at once in order to prevent blockages in other laterals. Many residents may find that some of their plumbing will also require replacement.
15. In the spring and fall it is recommended that the main lines be flushed. As the main line is polyvinylchloride and corrosion and or tubercule formation is not present "foam-swabbing" will not be required.

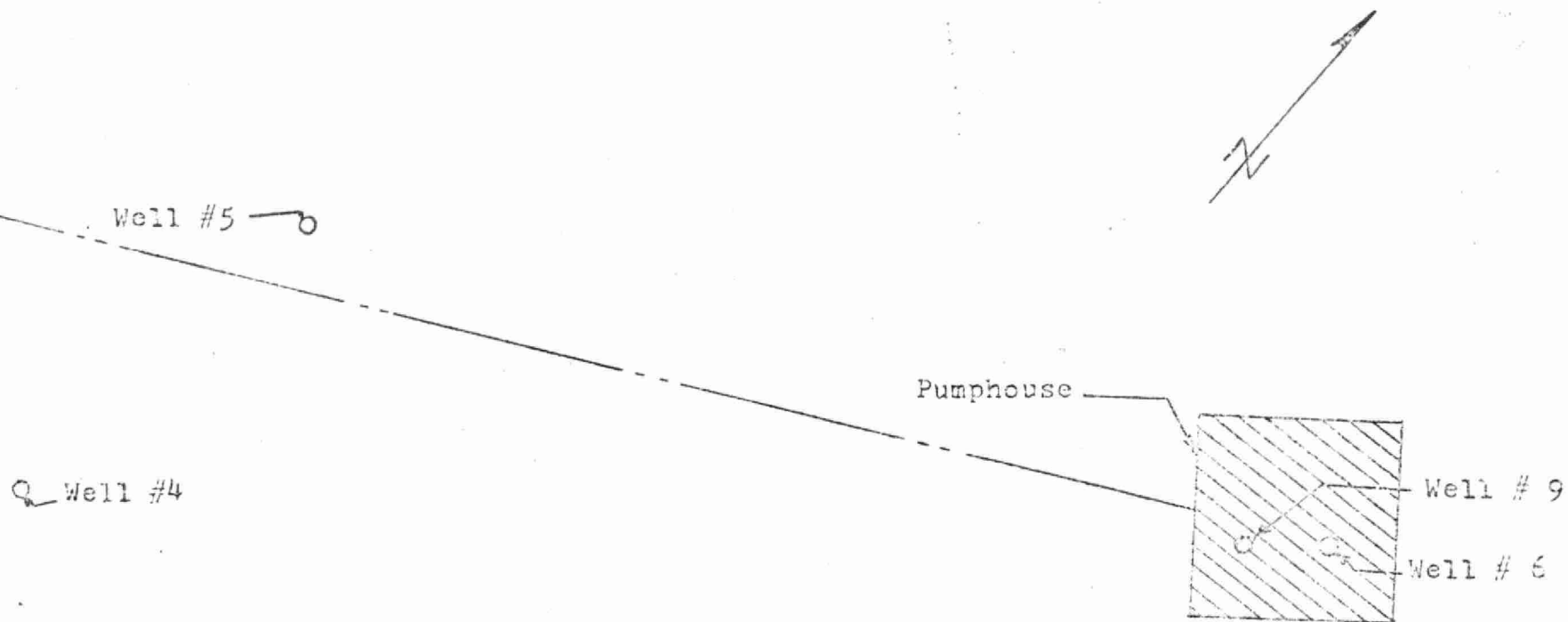
16. A routine sampling program should be initiated. Each month one chemical and two bacteriological samples should be taken of the treated water.
17. The township and developer should clarify the ownership contract for the water works serving the subdivision. As previously stated, the Township of Ameliasburgh alone obtained approval to construct the works.
18. If the treatment and operation is such that the iron continues to pose problems, the system will be designated as inadequate and a recommendation will be made to prevent further development of the subdivision. Such a recommendation would be enforced until adequate operation and/or treatment is devised.

REPORT PREPARED BY:

RAD/lc

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MINISTRY OF THE ENVIRONMENT

Water System for Subdivision
of Part of Lot 66 Conc 2
Township of Ameliasburgh
Pumphouse Site Plan

SCALE : 1" = 10'

DRAWN BY : RAD

DATE : Apr 27/72

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